Cm I claim:

Sub B1

1. An optical retarder system, comprising:

(a) first retarder means for controlling the retardance of light passing therethrough along a first eigen-axis thereof relative to a second eigen-axis thereof in response to the application of a first signal thereto; and

(b) first drive means, connected to said first retarder means, for supplying said first signal to said first retarder means, said drive means including first control means for changing said retardance from a first

drive

having a first required driving amplitude   having a second required amplitude

retardance to a second retardance by causing said first signal to change, in a direction to move toward said second retardance, from that amplitude which is required for said first retardance to an amplitude beyond that which is required for said second retardance for a period of time, and then causing said first signal to change to the amplitude required for said second retardance.

2. The optical retarder system of claim 1, wherein said first drive means includes means for increasing for a period of time said amplitude of said signal in excess of that amount needed to change the retardance of said first retarder means to a new, selected value, then setting said amplitude to that amplitude corresponding to said new, selected value.

Cp. 1-2

3. The optical retarder system of claim 2, wherein said first retarder means comprises a liquid crystal cell having two transparent plates disposed substantially parallel to one another, the surfaces of said plates facing one another and each having respective transparent electrodes disposed thereon, liquid crystal material disposed between said electrodes, and means for aligning said liquid crystal material in a predetermined manner.

4. The optical retarder system of claim 3, wherein said first drive means comprises means for applying to said transparent electrodes as said first signal an ac voltage of selected amplitude, and said control means comprises means for controlling said amplitude.

5. The optical retarder system of claim 1, wherein said first drive means comprises means for applying to said first retarder means as said first signal an ac voltage of selected amplitude, and said drive means comprises means for selecting said amplitude.

6. The optical retarder system of claim 4, wherein said ac voltage has a rectangular waveform of predetermined duty cycle.

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7. The optical retarder system of claim 1, further comprising:

(c) second retarder means for controlling the retardance of light passing therethrough along a first eigen-axis thereof relative to a second eigen-axis thereof by the application of a second signal to said second retarder means, said second retarder means being disposed relative to said first retarder means so that said light can pass through said first retarder means and said second retarder means

sequentially, said first eigen-axis of said second retarder means being substantially co-planer with said second eigen-axis of said first retarder means, and said second eigen-axis of said second retarder means being substantially co-planer with said first eigen-axis of said first retarder means; and

(d) second drive means for providing to said second retarder means said second signal for application to said second retarder means, said second drive means including second control means for changing said retardance from a third retardance to a fourth retardance by causing said second signal to change, in a direction to move toward said fourth retardance, from that amplitude which is required for said third retardance to an amplitude beyond that which is required for said fourth retardance for a pre-determined period of time, and then causing said second signal to change to the amplitude required for said fourth retardance.

8. The optical retarder system of claim 7, further comprising

a ~~difference~~ retardance difference control means, connected to said first control means and to said second control means, for causing the total retardance of light passing through both said first retarder means and said second retarder means to be increased by changing the amplitude of the signal applied to one said retarder means and to be decreased by changing the amplitude of the signal applied to the other said retarder means.

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9. The optical retarder system of claim 7, further including means for reducing the amplitude of said first signal and the amplitude of said second signal substantially the same amount so that the difference in retardance between said first retarder means and said second retarder means remains substantially constant.

10. The optical retarder system of claim 1, wherein said first drive means includes means for reducing, for a period of time, said amplitude of said signal below that amount needed to change the retardance of said retarder means to a new, selected value, then setting said amplitude to that corresponding to said new, selected value.

11. The optical retarder system of claim 10, wherein said first retarder means comprises a liquid crystal cell having two transparent plates disposed substantially parallel to one another, the surfaces of said plates facing one another and having respective transparent electrodes disposed thereon, liquid crystal material disposed between said plates, and means for aligning said liquid crystal material in a predetermined manner; and said drive means comprises means for applying to said transparent electrodes as said first signal an ac voltage of selected amplitude, and control means for controlling said amplitude.

12. The optical retarder system of claim 1, further comprising:

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(c) an input optical fiber;

(d) first coupling means for optically coupling light emerging from said input optical fiber to said first retarder means;

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(e) an output optical fiber; and

(f) second coupling means for optically coupling light emerging from said first retarder means into said output optical fiber.

13. The optical retarder system of claim 12, wherein either said first coupling means or said second coupling means includes a graded index lens.

14. An optical retarder system, comprising:

(a) first retarder means, including liquid crystal material, for controlling the retardance of light passing therethrough along a first eigen-axis thereof relative to a second eigen-axis thereof by the application of an electric field to said liquid crystal material, said first retarder means having a minimum retardance and a maximum retardance;

(b) first drive means for supplying to said first retarder means a first drive signal for producing said electric field;

(c) second retarder means, including liquid crystal material, for controlling the retardance of light passing therethrough along a first eigen-axis thereof relative to a second eigen-axis thereof by applying a second electric field to liquid crystal material of said second retarder means, said second retarder means being disposed relative to said first retarder means so

that said light passes through said first retarder means and said second retarder means sequentially, said first eigen-axis of said second retarder means being substantially co-planer with said second eigen-axis of said first retarder means, and said second eigen-axis of said second retarder means being substantially co-planer with said first eigen-axis of said first retarder means, said second retarder means having a minimum retardance and a maximum retardance;

(d) second drive means for supplying to said second retarder means a second drive signal for producing said second electric field; and

(e) retardance difference control means, connected to said first drive means and to said second drive means, for adjusting the retardance of said first retarder means and the retardance of said second retarder means to respective intermediate values between said respective minimum and maximum retardances thereof so that the difference in retardance between the two is a predetermined amount.

15. The optical retarder system of claim 14, further comprising one or more additional pairs of first and second retarder means, corresponding first and second drive means and corresponding retardance difference control means, stacked relative to one another so that light can pass through each such retarder means sequentially, and stack control means, coupled to said difference control means, for

selecting which of said pairs of retarder means changes the retardance of light passing through said stacked retarder means.

16. The optical retarder system of claim 15, wherein each said drive means includes means for changing the retardance of said retarder portion from a first retardance to a second retardance by causing the amplitude of said drive signal to change, in a direction to move toward said second retardance, from that amplitude which is required for said first retardance to an amplitude beyond that amplitude which is required for said second retardance for a predetermined period of time, and then causing said drive signal to change to the amplitude required for said second retardance.

17. The retarder system of claim 15, wherein each said drive means includes means for reducing the amplitude of said drive signal for one retarder means and the amplitude of the drive signal of the other retarder means of a pair of retarder means substantially the same amount so that the difference in retardance between both said retarder means remains constant.

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18. An optical polarization control system, comprising:

(a) a coherent optical input signal source;

(b) a coherent optical reference signal source;

(c) detector means for receiving light from said input signal source and from said reference signal source and producing an output signal representative of the intensity of light illuminating said detector;

(d) an optical retarder system, disposed between said input signal source or said reference signal source and said detector means, for controlling the retardance of light passing therethrough, said optical retarder system having:

(i) retarder means for controlling the retardance of light passing therethrough along a first eigen-axis thereof relative to a second eigen-axis thereof in response to the application of a signal thereof; and

(ii) drive means, connected to said retarder means, for supplying said electric signal to said retarder means, said drive means including control means for changing said retardance from a first retardance to a second retardance by causing said signal to change, in a direction to move toward said second retardance, from that amplitude which is required for said first retardance to an amplitude beyond that which is required for said second retardance for a period of time, and then causing said signal to change to the amplitude required for said second retardance; and

(e) control means, responsive to said output signal and connected to said drive means, for maintaining a predetermined polarization relationship between said input signal and said reference signal.

19. An optical polarization control system, comprising:

(a) a coherent optical input signal source;

(b) a coherent optical reference signal source;

(c) detector means for receiving light from said input signal source and from said reference signal source and producing an output signal representative of the intensity of the light illuminating said detector;

(d) an optical retarder system, disposed between said input signal source or said reference signal source and said detector means, for controlling the retardance of light passing therethrough, said optical retarder system having:

(i) first retarder means, for controlling the retardance of light passing therethrough along a first eigen-axis thereof relative to a second eigen-axis thereof by the application of a first signal thereto;

(ii) first drive means for supplying to said first retarder means said first signal;

(iii) second retarder means for controlling the retardance of light passing therethrough along a first eigen-axis thereof relative to a second eigen-axis thereof by applying a second electric field to liquid crystal material of said second retarder means, said second retarder means being disposed relative to said first retarder means so that said light passes through said first retarder means and said second retarder means sequentially, said first eigen-axis of said second retarder means being substantially co-planer with said

second eigen-axis of said first retarder means, and said second eigen-axis of said second retarder means being substantially co-planer with said first eigen-axis of said first retarder means;

(iv) second drive means for supplying to said second retarder means a second signal for producing said second signal; and

difference

a

(v) difference control means, connected to said first drive means and to said second drive means, for adjusting the retardance of said first retarder means and the retardance of said second retarder means so that the difference between the two is a predetermined amount; and

(e) control means, responsive to said output signal and connected to said drive means, for maintaining a predetermined polarization relationship between said input signal and said reference signal.

20. A method for controlling an optical retarder for controlling the retardance of light passing therethrough along a first eigen-axis thereof relative to a second eigen-axis thereof in response to the application of signal thereto, said method comprising:

(a) supplying a signal to said retarder to control its retardance;

(b) changing said retardance from a first retardance to a second retardance by causing said signal to change, in

a direction to move toward said second retardance, from that amplitude which is required for said first retardance to an amplitude beyond that which is required for said second retardance for a period of time; and

(c) thereafter causing said signal to change to the amplitude required for said second retardance.

21. A method for controlling an optical retarder system having first and second retarders employing liquid crystal material for controlling the retardance of light passing therethrough along a first eigen-axis thereof relative to a second eigen-axis thereof by the application of an electric field to said liquid crystal material, said second retarder being disposed relative to said first retarder so that said light passes through said first retarder and said second retarder sequentially, said first eigen-axis of said second retarder being substantially co-planer with said second eigen-axis of said first retarder, and said second eigen-axis of said second retarder being substantially co-planer with said first eigen-axis of said first retarder means, said retarders each having minimum and maximum retardance values, said method comprising:

(a) applying a first electric field to the liquid crystal material of said first retarder;

(b) applying a second electric field to the liquid crystal material of said second retarder; and

(c) adjusting the retardance of said first retarder and the retardance of said second retarder to respective intermediate values between said respective minimum and maximum retardances thereof so that the difference in retardance between the two is a predetermined amount, by adjusting the amplitudes of said first electric field and said second electric field respective predetermined amounts.